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Thank you, Mr. Chairman. I appreciate the opportunity to present the findings of the Department of Energy's (DOE) independent oversight investigation into environment, safety and health (ES&H) concerns raised at the Paducah Gaseous Diffusion Plant (PGDP). These ES&H concerns included: inadequate controls for workers exposed to uranium and transuranic elements, ineffective communication of hazards and radiation exposures to workers; and improper release, dumping, or burial of radioactive and other hazardous materials at unapproved onsite and offsite locations.

The Paducah investigation was one of three directed by the Secretary of Energy in August 1999 to cover potential ES&H issues at the gaseous diffusion plants. As you know, we are currently conducting the investigation at the Portsmouth plant in Piketon, Ohio, and are just beginning one at the former gaseous diffusion plant in Oak Ridge, Tennessee.

The Paducah investigation was divided into two phases: the first was designed to provide timely information on the status of current operations, and the second was intended to be a more lengthy investigation of historical operations. The first phase of the investigation concentrated on the period 1990 to the present and included the current facilities, areas, operations, and activities that are the responsibility of the DOE and its current management and integrating contractor. Operations controlled by the United States Enrichment Corporation (USEC) were not evaluated. A report on the findings of the first phase of the investigation was published in October 1999. Among its major findings were:

- There had been limited progress in remediating and characterizing environmental contamination, low-level wastes, and stored hazardous materials that were produced by past industrial activities.

- There were continuing weaknesses in the radiation protection management of known environmental contamination areas by both Bechtel Jacobs and DOE.

- Radiological exposure pathways for DOE operations had not been fully assessed or documented.

- Groundwater contamination had not been adequately characterized in some areas.

- Unclear assignment of responsibilities and weaknesses in the integration and interpretation of environmental information had adversely impacted the understanding of environmental conditions.

- Incomplete radiological characterization of the workplace adversely affected the ability of the radiological control organization to identify hazards and institute controls as necessary to ensure consistent and appropriate radiological protection for workers.

- There was a lack of rigor, formality, and discipline in the development, maintenance, and implementation of the Bechtel Jacobs radiation protection program.

- Criticality safety deficiencies in DOE Material Storage Areas had not been resolved by DOE in a timely manner, posing an unnecessary hazard to workers in surrounding areas.

- Safety and health procedures were not consistently applied and followed, and in some cases, hazards are not adequately addressed by those procedures.

- Bechtel Jacobs had not assured that subcontracted medical personnel were sufficiently involved in the identification, evaluation, and integration of workplace hazards to ensure effective worker medical programs.

- Bechtel Jacobs training programs did not ensure that all workers are knowledgeable of hazards and protection requirements, including those associated with transuranic contamination.

- DOE had not conducted effective oversight of ES&H or ensured that Bechtel Jacobs and its subcontractors effectively implement all DOE and regulatory requirements.

- Bechtel Jacobs had not conducted fully effective oversight of ES&H performance or ensured that its subcontractors effectively implement all DOE and regulatory requirements and are held accountable.

The complete results of this investigation were presented to the Committee last September. As Dr. Huntoon, Assistant Secretary for Environmental Management, will testify, some immediate actions were initiated to address these issues, including posting (i.e., identification) of radiological hazards both on and off DOE property and training. A corrective action plan was developed and is currently being implemented to address the more complex ES&H program weaknesses identified in the Phase I investigation. My office has reviewed the plan and provided feedback to the DOE program offices.

The second phase of this investigation addressed historical conditions and uranium enrichment activities from startup of the Plant in 1952 until 1990. The Phase II investigation focused on:

- Identifying the concerns and questions of current and former workers and their level of understanding of site hazards and ES&H practices;

- Understanding the operations, activities, conditions, and hazards in the workplace;

- Identifying the management practices and controls employed and the applicable standards and regulations;

· Determining where management practices and controls may not have been effective in protecting workers, the public, or the environment.

A vast amount of information was collected and analyzed to accomplish these objectives. To better understand the various site operations and conditions, the investigation team interviewed hundreds of current and former workers and managers, reviewed thousands of historical records and documents, toured workplaces, and performed limited walk-over surveys of possible disposal sites. The team examined dozens of events, about 40 separate major operations and activities, and related ES&H practices.

The intent of this investigation was to identify and address the overall ES&H concerns and questions of current and former workers and the public, not to determine the validity of specific allegations. Several ongoing or proposed initiatives of the DOE Office of Environment, Safety and Health should provide greater understanding of certain aspects of these issues:

· The mass balance project will recreate the historical flow of recycled uranium and its contaminants across the DOE complex.

· The medical surveillance project will determine the presence and prevalence of adverse worker health effects from employment at GDPs.

· The exposure assessment project will determine how many workers at the GDPs were exposed to radiation, to how much, and from what source.

Determining any long-term effects on employee health from working conditions and management practices at the Paducah Plant will require study that is beyond the scope and resources of this investigation. Similarly, detailed examination of any work that the Paducah Plant might have performed for others in relation to weapons systems as well as the effectiveness of any associated ES&H practices was not part of the investigation.

Results

Certain external conditions and influences had a significant effect on the ES&H-related behavior and intentions of both management and workers at the Paducah Plant during the 1952-1990 period. When the Paducah Plant started operation, World War II had recently ended, the country was involved in a major conflict in Korea, and the Cold War was a reality. Many of the workers were military veterans. The work being done was classified, involved high technology, and was important to the national defense. The "need to know" was an ingrained security policy that had a major effect on attitudes toward sensitive operations and materials at the PGDP.

The Paducah Plant was the biggest employer in the region, paying wages significantly higher than previously available in this rural farming area; people in Paducah and the

surrounding area wanted these jobs. Management at the plant and at the Atomic Energy Commission (AEC) were under pressure to maximize production. Workers in this environment were not inclined to ask many questions. While most of the hundreds of workers interviewed by the team indicated, in response to specific questioning, that they were unafraid to ask questions about safety and they had no fear of reprisals, a few interviewees did express concerns about both. Further, industries in the 1950s, including AEC facilities, were largely self-regulated, and guidance and regulatory requirements were minimal and evolving. Significant industrial and environmental legislation that would focus attention and actions toward greater protection of workers and the environment was not enacted until the 1970s.

During the period 1952 to the early 1980s, oversight by the governing Federal agencies -- AEC, the Energy Research and Development Administration (ERDA), and DOE -- was primarily directed at cost, schedule, and production, not ES&H. A March 1960 letter revealed that AEC and contractor management, including the PGDP Health Physics and Hygiene Department, were aware of the potential hazards presented by transuranic elements contained in the feed material the Plant received from Hanford reactor tails and the workers' lack of compliance with respiratory protection measures. The document stated that 300 persons at Paducah "should be checked out," but that management was hesitant to study the issue intensively for fear that the labor union would demand hazard pay.

Health and safety programs were always in place and functioning at the Paducah Plant, with a strong emphasis on industrial safety. Policies, procedures, and training were provided that addressed hazards in the workplace and specified recommended personnel protection and controls. Safety meetings were frequent, and job hazard analyses that described hazards and controls were soon developed for most work activities. The Health Physics and Hygiene Department, although minimally staffed for most of the 38 years covered in this investigation, was active in studying hazards and health effects, analyzing air monitoring results, surveying work areas, and recommending engineering and administrative controls for identified hazards. Fixed and portable ventilation and vacuum systems were installed in some areas to control workers' exposure to radiation and chemicals as well as the spread of contamination. Safety glasses, gloves, and hearing protection were made available to workers, and for certain work activities, the company supplied coveralls, shoes, caps, undergarments, and respiratory protection equipment; use of this equipment, however, was not uniformly required or monitored. By 1960, all personnel exposures to radiation were monitored using film badges and, for targeted workgroups, bioassay techniques, including scheduled and event-driven urinalysis and lung counting. Workers showing high uranium excretion rates were removed from high exposure work. Workers who were excreting uranium over threshold limits were put on a recall urinalysis program until their excretion rates fell to baseline levels, usually within hours or days. Exposures to fluorides were also monitored through the urinalysis program.

Radiological and chemical hazards and exposure risks to personnel were much higher in certain work locations and activities at the Plant than in others. Significant external and internal exposure to concentrated transuranics was possible in handling feed production ash and in

uranium, neptunium, and technetium recovery operations. Feed plant operations, during the processing of recycled uranium, presented high exposures to airborne UO_3, uranium tetrafluoride (UF^4), and to hydrofluoric acid (HF). Exposure to airborne UF^4, magnesium powder, uranium oxides, and HF was possible in the metals plant. Maintenance and modification activities involved potential airborne and point source exposures to uranium hexafluoride (UF^6), HF , UO_2F_2, transuranics, and uranium daughter products in many locations; these activities included bag house filter changeouts, converter modification work, and compressor and seal disassembly repair and replacement. Workers performing decontamination and cleaning operations in Building C-400 had significant exposures to trichloroethene (TCE) in addition to radioactivity.

Although a general intent to protect workers from hazards was apparent, the protection programs were not always conservative or consistent. Air emissions, liquid effluents, and solid waste disposal were consistent with practices in general industry and the DOE complex at the time (e.g., dilution, burial, and burning) but resulted in significant adverse impacts on the environment. The following sections summarize the conditions, practices, and consequences in key ES&H areas.

Radiological Protection

The risks and hazards of exposure to uranium and transuranics were neither fully understood nor appreciated. PGDP considered that intakes of uranium were from soluble compounds and would be quickly excreted through the kidneys. This assumption may not have been accurate for all uranium compounds at the Plant, particularly aerosols generated in the feed plant and during maintenance operations such as grinding, buffing, or welding. The comfort level of PGDP technical staff regarding exposure to uranium is reflected in a research experiment, conducted in the late 1950s, where Health Physics and Hygiene staff members voluntarily inhaled and ingested known quantities of uranium compounds to measure excretion rates. In addition, in 1956, test subjects at the Plant, wearing different types of respirators, were exposed to several known concentrations of airborne uranium compounds to determine subsequent excretion rates.

External exposures were monitored using film badges. However, extremity dosimetry was not employed, even though requirements dating from the late 1950s mandated that such monitoring be conducted when the potential exposure could exceed 10 percent of the extremity limit. Over the 38 years of operations, only two exposures over regulatory limits were documented. However, due to high concentrations and variable dose rates in certain areas of the Plant, workers in these areas may have received significant unmonitored exposures to hands and feet during some operations. The concept of keeping exposures as low as reasonably achievable (ALARA) was, in various forms, AEC/ERDA/DOE policy. However, PGDP policies and practices focused on preventing personnel exposures from exceeding Federal Radiation Protection Guidelines, rather than keeping them as low as reasonably achievable.

Contamination controls at Paducah were limited, even into the early 1980s. Eating, drinking, and smoking in contaminated work areas was common practice. Although personnel wearing company clothing typically showered before changing into their personal clothes and leaving the site, the practice was not mandatory, and workers were not required to wash their hands and other exposed skin, or remove contaminated clothing, before entering cafeterias, break areas, and even the main site meeting area in the C-100 "Roxie theatre." Friskers and whole body monitors were not employed until the mid-1980s. As a result, Plant workers probably took radioactive contamination outside site boundaries.

As early as 1957, the site became aware of the presence of transuranic elements (those with atomic numbers higher than uranium) and fission products in feed materials processed from spent reactor fuel at the Hanford and Savannah River Sites. Transuranics and fission products have a much higher specific activity than uranium and resulted in much higher dose to some workers. These materials were a concern where they were concentrated, such as in the "heels" remaining in empty UF^6 cylinders and in the uranium, technetium, and neptunium recovery processes, or where there was airborne exposure such as reactor tails feed material ash in the feed plant, metals production, and maintenance/modification activities. However, the presence of these materials, the increased risks involved, and the rationale for additional controls were not shared with workers. Workers' incomplete awareness of these hazards contributed to and fostered inconsistent compliance with recommended protective measures.

Initial comprehensive operations training programs, which included radiation theory and control, quickly declined in scope and frequency as resources and attention focused on production. Information concerning workplace radiation and chemical hazards and protective measures was subsequently communicated primarily through informal on-the-job training, passed from experienced workers to new ones. Although exposure history information was collected from monitoring film badges, bioassays, and lung counts, it was not openly communicated, nor was its meaning explained to workers unless requested.

The Health Physics and Hygiene Department provided monitoring, investigation of elevated intakes and air samples, and recommendations for radiological controls. However, line management had ultimate responsibility for implementing radiation protection measures. In many cases, recommendations for controls or improved protection were the result of high exposures or sample readings, rather than conservative, proactive planning. Workers' compliance with recommended controls (engineering, procedural, and personal protective equipment or PPE) and management's enforcement of compliance were inconsistent. In many areas, individual workers or supervisors decided whether recommended PPE would be used, and early masks and respirators did not fit well, hindering vision in work environments. The inconsistent use of respirators was especially important because they were heavily relied on to minimize workers' inhalation of radioactive materials.

Chemical Hazard Exposure

Acute and chronic exposures to a number of hazardous chemicals used at the Plant were frequent occurrences, and the risks and long-term health effects of such exposures were not fully recognized by the Health Physics and Hygiene Department and consequently, by the workers. Exposures to polychlorinated biphenyls (PCBs), TCE, fungicides used on the cooling towers, and asbestos did not result in apparent, immediate health effects, nor was there recognition of adverse long-term health effects. National standards related to exposure to these materials did not appear until the 1970s or 1980s. An asbestos screening program for asbestos workers was initiated by the Oil, Chemical & Atomic Workers International Union in the mid-1980s. Exposures to caustic HF resulted in frequent burns and respiratory injury. The effects of these exposures were believed to be temporary only, when, in fact, there may be long-term consequences.

Airborne Emissions

Radioactive and fluorine emissions to the atmosphere from stacks, diffuse and fugitive emissions, accidents, and a small number of planned releases have occurred since Plant startup in 1952. Process knowledge was used to estimate potential releases before the mid-1970s. Published reports estimated that approximately 60,000 kilograms of uranium were released to the atmosphere from 1952 to 1990, 75 percent before 1965. There is evidence that past estimates did not include all process gas releases, diffuse emissions, accidental releases, and unauthorized process gas venting. Consequently, the accuracy and conservatism of past public dose estimates are questionable.

Liquid Effluents

Liquid effluents from past operations have had a significant adverse impact on the environmental quality of onsite ditches and streams and groundwater sources in the vicinity of the site. Uranium, thorium, TCE, and small quantities of transuranics and fission products have been released to the environment, primarily from cleaning and decontamination in Building C-400. Significant amounts of chromates and fluorides were released to the environment, as approximately 500,000 gallons of recirculating cooling tower blowdown water were pumped into Little Bayou Creek every day. From the beginning of Plant operations, liquid effluent control was based on dilution, with the objective of ensuring no unacceptable impact on the Ohio River; there was much less concern about onsite and local waterways and groundwater. As a result of increasing regulatory requirements and an increased sensitivity to environmental protection, significant efforts were undertaken in the 1970s that improved the quality of area surface waters.

Waste Disposal

Radioactive and chemically hazardous materials were dumped and buried in numerous locations both inside and outside the site fence. Hazardous and radioactively contaminated materials were often mixed with normal trash and waste materials, and waste disposal was not

well monitored, controlled, or documented. Large quantities of radioactive materials, including uranium metals and powders and contaminated waste, were packed in metal barrels and buried. Contaminated empty barrels remain piled in "Drum Mountain." Contaminated concrete rubble and roofing materials were disposed outside the Plant boundaries, some in wildlife areas where public use and access were authorized and encouraged. Contaminated sludge and floor sweepings were placed in landfills, and the sludge was applied to Plant lawns as fertilizer. Rainfall runoff and leaching have moved contaminants from the disposal sites into the surrounding environment. Federal environmental regulations were enacted in the 1970s, and the Material Terminal Management organization, established in the early 1980s, implemented an integrated waste management program that reduced the amount of radioactive waste disposed of on site and achieved greater control over waste segregation and disposal.

Summary

External conditions significantly affected the policies, practices, and performance of PGDP management (both the Federal owners and the contractors) and workers during the first 38 years of Plant operation. To put PGDP conditions and activities into perspective, it must be considered that almost 50 years ago there was a significantly smaller body of knowledge about radiation, chemical, and other industrial hazards and their effects on humans and the environment. While evidence reviewed indicates that managers were generally concerned with the safety and health of workers, management decisions and practices were not always conservative. Consequently, worker radiation exposures were poorly controlled and higher than necessary, and some workers may have been exposed to hazards that were not adequately monitored or understood. Communication of hazards, the rationale for protective measures, and information about radiation exposure were inadequate. Further, workers were exposed to various chemical hazards for which adverse health effects had not yet been identified. Environmental practices prior to Federal and state legislation in the 1970s and 1980s resulted in many adverse impacts to the environment, both on and off Federal property.

The findings of this investigation, together with similar investigations at the Portsmouth and Oak Ridge GDPs, will be used to inform the Clinton/Gore Administration’s legislative efforts to compensate workers who have become ill because of workplace exposures.

That completes my statement. I would be pleased to answer any questions from the Committee.